Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 73449

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth Semester

Electronics and Communication Engineering

EC 2255/EC 46/EE 1256 A/10144 EC 406/080290023 – CONTROL SYSTEMS

(Regulations 2008/2010)

Time : Three hours | Maximum : 100 marks

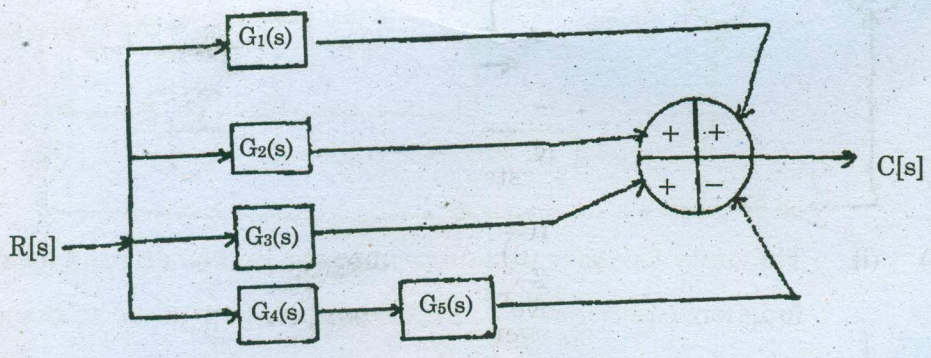
(Polar Graph sheet)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages of the closed loop control system?

2. Write down the transfer function of the system whose block diagram is shown below.



3. The closed loop transfer function of a second order system is given by $\frac{400}{s^2+2s+400}$. Determine the damping ratio and natural frequency of oscillation.

4. Give the steady state errors to a various standard inputs for type-2 system.

5. What is the use of Nichol's chart?

6. List the advantages and disadvantages of phase lag network.

7. What are constant M and N circles?

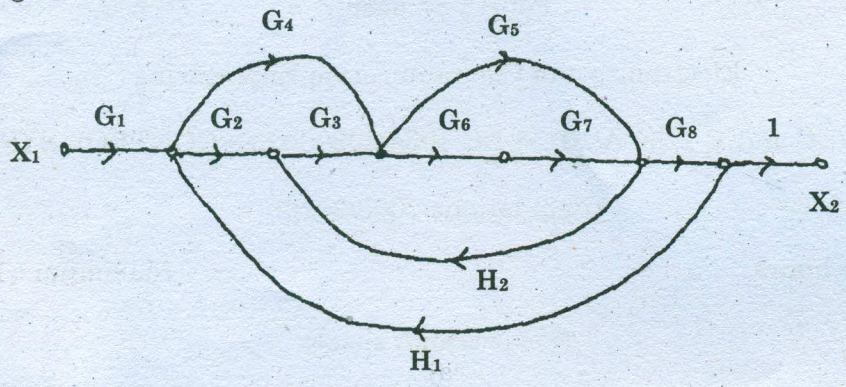
8. State the property of a lead compensator.

9. Define Nyquist stability criterion.

10. Define gain margin and phase margin.

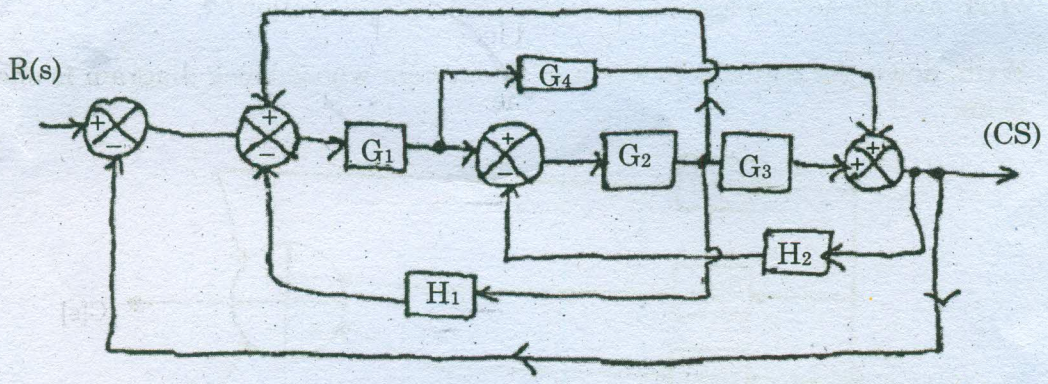
PART B — (5 × 16 = 80 marks)

11. (a) For the signal flow graph shown below, evaluate $\frac{X_2(s)}{X_1(s)}$ using Mason's gain formula.



Or

(b) Find the transfer function $\frac{C(s)}{R(s)}$ using block diagram reduction technique.



12. (a) (i) The unity feedback system is characterized by an open loop transfer function $G(s)=\frac{K}{s(s+10)}$. Determine the gain K, so that the system will have a damping ratio of 0.5. For this value of K, determine settling time, peak overshoot and time to peak overshoot for a unit step input. (8)

(ii) A unity feedback system has the forward transfer function $G(s)=\frac{K_1(2s+1)}{s(5s+1)(1+s)^2}$. The input $r(t)=(1+6t)$ is applied to the system. Determine the minimum value of K_1, if the steady error is to be less than 0.1. (8)

Or

(b) With suitable block diagrams and equations, explain the following types of controllers employed in control systems :

(i) Proportional controller (4)

(ii) Proportional-plus-integral controller (4)

(iii) PID controller (4)

(iv) Integral controller. (4)

13. (a) (i) Define all the frequency domain specifications of a second order control system after plotting the response. (8)

(ii) Sketch asymptotic plot of the system with loop transfunction $G(s)H(s)=\frac{K}{(1+0.2s)(s^2+8s+64)}$. (8)

Or

(b) Sketch the polar plot for a system whose loop transfer function is $\frac{4}{(s+2)(s+4)}$. Find Gain margin and Phase margin.

14. (a) Consider the sixth order system with the characteristic equation $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$. Use Routh-Hurwitz criterion to examine the stability of the system.

Or

(b) Sketch the root locus of the system having $G(s)=\frac{k(s+3)}{s(s+1)(s+2)(s+4)}$.

15. (a) Consider a system with state-space model given below.

$$x=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -2 & -3\end{bmatrix}x+\begin{bmatrix}0\\ 0\\ 4\end{bmatrix}u;\ y=\begin{bmatrix}2 & -4 & 0\end{bmatrix}x+(0)u$$

Verify whether the system is observable and controllable.

Or

(b) Explain the functional modules of closed loop sampled data system and compare its performance with open loop sampled data system.